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THIRD ANNUAL REPORT OF THE DIRECTOR, FOR 1891.

SUBMITTED TO THE TRUSTEES JAN. 13, 1892.

To the Board of Trustees of the Missouri Botanical Garden:

In compliance with the rules of the Board, I respectfully submit the following report on the Missouri Botanical Garden and the Henry Shaw School of Botany.

THE BOTANICAL GARDEN.

During the past season no effort has been spared to maintain and augment the ornamental features of the Garden, so far as the funds at the disposal of the Board permitted, and to make it both pleasing and instructive to the public. The number of visitors during the year, so far as can be estimated in the absence of automatic registers, has been somewhat greater than in 1890, and on the open Sundays, in June and September, very large numbers of people visited the grounds. With few exceptions visitors have been orderly, and little damage has been done to property.

Throughout the year about fifty men have been employed on the grounds, at an aggregate expense of something over \$20,000.00 for the year. Besides the necessary work of maintenance, many repairs and improvements have been made. These have been reported in detail in my monthly reports. By way of summary it may be said here that they have included excavating and remaking in a substantial manner some 5,100 running feet of walks; laying about 3,200 feet of drain and sewer pipe, and making the necessary surface connections and silt pits; resetting 3,380 feet of brick edging; grading and laying sod on about 13,000 square feet of ground, and grading and seeding about 30,000 square feet of lawn; removing the unsightly shed and broken fences from the rear and sides of the

vegetable garden; repairing various fences, well-houses, and summer houses, and the farm barn, which had become very dilapidated and insecure; tearing down and rebuilding from the foundations the west wing of the main greenhouse, to which reference was made in my last report; and thoroughly pointing and painting the main greenhouse inside and out. All of the sets of steps about the parterre, which had become much decayed, have been removed and reconstructed in granitoid; the dilapidated wooden fence at the rear of the residence has been rebuilt, the center in granitoid and iron; a refrigerating drinking fountain has been set at the gate of the Garden; and the very unsightly and decayed picket fence along the north front of the arboretum, 1,040 feet in length, has been replaced by a neat barbed wire fence with ornamental cresting, thus opening up a very pretty view into the grounds to persons driving along Shaw avenue.

In accordance with plans previously announced, a beginning has this year been made toward putting the fruticetum in order by removing some of the old and useless trees and nursery stock; subsoiling 210,600 square feet of ground (in the main already underdrained), of which 33,525 square feet was spaded 30 inches deep, 10,500 square feet 24 inches deep, and the remainder about 10 inches deep; replacing the broken brick edging of walks in the southeastern quarter of the inclosure by sod 20 inches wide; and planting a small experimental orchard, comprising 68 varieties, of which 19 are apples, 4 peaches, and 15 grapes. In addition to containing the necessary orchard, it is intended that the fruticetum shall be made to correspond with its name by growing in it specimen shrubs, representing as great a variety of species as is practicable in the restricted area.

Notwithstanding the extent of the repairs and improvements executed during the past two years, and regardless of any material extension of the Garden and its greenhouses, this work can scarcely be said to be more than begun, since

it may be found necessary to reroof the Agave house during the coming season, in addition to making repairs on other greenhouses, while the smoke issuing from the flues of all of these houses when the fires are replenished late in the afternoon, is so objectionable that one of the first large improvements contemplated must be the provision of a single central stoke hole, containing boilers sufficient to heat all of the plant houses and provided with adequate smoke-consuming devices. The walks of arboretum, fruticetum, and vegetable garden, which in bad weather are very unsatisfactory, must also be remade in a substantial manner, as this work can be afforded; and considerable additional fencing is required to place the grounds in a presentable condition, a neat barbed wire fence between the arboretum and fruticetum being particularly desirable.

For the first time in my experience, the entire grounds have been kept free from weeds through the year, and in most respects a creditable appearance has been maintained. Owing to the severe drought during the entire summer and autumn, however, and the inadequacy of the city water supply through the same period, the lawns suffered even more than in 1890, the blue grass being entirely destroyed and replaced by annual species over large areas.

In addition to procuring numerous plants for the greenhouses, among which should be mentioned numerous species brought from the West Indies by Mr. Hitchcock, a systematic effort has been made to introduce hardy native species into the grounds. For their accommodation a bog and artificial pond were made, and many small beds prepared in the southern part of the arboretum. Under the direct care of Mr. F. H. Horsford, an experienced grower of native plants, some 1,500 species were introduced, of which the greater number are established, though the severity of the season and the refractory character of the soil have rendered success much more difficult of attainment than has usually been the case in Mr. Horsford's experience. The number of species already planted in this "wild garden" is about

equal to the entire phænogamic flora of a State, and rather greater than that of the British Islands. While several years must pass before the best results can be hoped for, and some of the species may require frequent renewal, this part of the Garden is a most essential one, and during the past year the plants in it have proved attractive to many visitors, and have been particularly interesting and instructive to pharmacists who have visited the grounds, inasmuch as the collection includes a large number of officinal plants.

Several hundred tree labels have been placed in the course of the year, some consisting of metallic plates coated with "granite ware" enamel, in which the names were fired in a contrasting color, while others are of a "white bronze" alloy now much used in monument work, and bear the names in raised letters. As rapidly as possible, all of the trees are being named in this manner. Shrubs are labeled by means of plates of celluloid, bearing the names in indelible ink, and affixed by copper wire; and the same kind of labels, wired to long iron rods capable of being thrust far enough into the ground to escape displacement by frost, is being employed for herbaceous plants in the bog and other parts of the wild garden.

The herbarium has been augmented by the purchase of the more important current collections of American plants offered for sale during the year, as well as by the purchase of a very full set of the grasses in the herbarium of the late Dr. George Thurber, and the acquisition of many desirable specimens through exchange and the donations of correspondents, to whom the thanks of the institution are tendered. As a result of the collecting cruise of Mr. Hitchcock in the West Indies, referred to in my last report, some 2,000 valuable specimens, representing very fully the flora of the islands he visited, have been added to the herbarium, which, together with that part of the library referring to the botany of the same region, is believed by Mr. Hitchcock to be now quite as complete as any in the country.

The Engelmann and Bernhardt herbaria, referred to in my last report, have now been mounted and arranged, and it appears that their contents are as follows:—

Engelmann Herbarium, about 98,000 specimens.

Bernhardt “ “ 57,500 “

In accordance with a plan formed several years since, my private herbarium, chiefly of fungi, including about 11,000 specimens representing some 4,000 species, was donated to the Garden in November last, and will form the nucleus for a collection of thallophytes which will be gradually brought together. In accepting this gift, which was made because of my belief that no person intrusted with the care and increase of a public collection can at the same time work for a private collection without serious detriment to the former, the Board indorsed this opinion, and voted that employees of the Garden shall hereafter be allowed to form private collections only by the written permission of the Director.

In compliance with the requirements of Mr. Shaw's will, the residence formerly occupied by him at the corner of Seventh and Locust streets has been rebuilt within the southeastern angle of the stone wall inclosing the grounds (G5, of map published in first report), facing on Tower Grove avenue. In its present condition, the building is fire-proof, and has been set apart for the use of the herbarium and library. Together with the Museum and the residence of the Director, this building is heated by steam from a boiler pit located at a safe distance from all.

Owing to heavy expenses in other directions, the library has been added to more slowly during the past year than in 1890, but some \$4,300.00 has been expended on it, and the additions include a number of valuable and scarce works and sets of journals. In connection with the herbarium already referred to, my collection of about 500 books and 3,000 pamphlets was presented to the Garden, and will be incorporated in the general library, which now contains

some 6,000 volumes,—many of them composed of pamphlets and hence representing a number of titles much greater than this. As I had hoped might be the case, the exchanges of publications offered the Garden are increasing, and some 185 institutions have already placed the library on their mailing lists.

With the transfer of the herbarium and library to their new quarters, the small museum room will become vacant again, and it is proposed to arrange in it an instructive synoptical collection in either systematic botany or some branch of economic botany; but the expense and slowness of making a suitable and properly arranged collection, even though it be small, are such as to render it improbable that the building can be opened to the public during the coming year.

Throughout the year Mr. Duffey has given to experimental work, and observations on noxious insects, such time as could be spared from his practical duties. The principal results of his work in spraying plants for the destruction of injurious insects and fungi were presented by him to the State Horticultural Society, at its recent meeting in Sedalia, and will be published, with illustrations, in the forthcoming report of the Society. Among the practical results reached was the discovery that by forcibly spraying the smaller cacti with pure water by means of a force pump and Vermorel nozzle, the mealy bugs, so troublesome because of their habit of ensconcing themselves between the bases of the spines, may be dislodged without injury to the plants and at less than one-fourth of the usual expense, since it has heretofore been thought necessary to remove them individually by hand, by the aid of brushes or pointed bits of wood,—a laborious process which, moreover, sometimes results injuriously to the plants. As a result of Mr. Duffey's leave of absence, reported a year ago, he has been enabled to determine the scale insects of the Garden satisfactorily, and now has in hand observations on the life history of several representatives of this injurious group.

The collections made in the West Indian region by Mr. Hitchcock, and to which I have already referred, have occupied the greater part of such time as he could spare from routine work during the year, and, to afford him access to type specimens and certain works not in the Garden library, he was allowed to spend the greater part of December last at the Herbarium of Harvard University, making brief stops also at Columbia College, and the Department of Agriculture at Washington. As a result of his studies he has prepared a somewhat lengthy paper, which is believed to be a useful contribution to the botany of the region, and which will be published in the fourth Garden volume. The only botanical work which I myself have been able to complete during the year is a revision of our species of *Rumex*, which will soon be published.

Since my last report was submitted, two garden pupils have resigned their scholarships, — one to enter his father's business as a florist, the other through lack of interest in gardening. Only two awards were made in 1891, and the plans of one of the new appointees were changed shortly after he had received a scholarship, so that virtually only one was awarded. The character of the work done by pupils has been satisfactory in the main, though it is not always easy to convince them of the necessity for a thoroughgoing interest in every step taken. In addition to the requisite manual work, the second year pupils have received theoretical instruction in the studies for that year, from Mr. Duffey and Mr. Gurney. In November last a third announcement was issued, in which it was stated that three scholarships were to be awarded prior to the first of April, 1892, one of the number being reserved from competition, for the use of the St. Louis Florists' Club.

Four annual events provided for under the will of Henry Shaw, have taken place in the course of the year, viz.: the delivery of the second flower sermon, in Christ Church Cathedral, by Rev. Montgomery Schuyler; the second

banquet to the Trustees of the Garden and their guests, presided over by the Bishop of Missouri; the second banquet to gardeners, florists and nurserymen, presided over by the Director of the Garden; and the award of the first Shaw premiums at a floral exhibition, given under the auspices of the Florists' Club of St. Louis.

The flower sermon will be printed in the third report, which will also contain abstracts of the proceedings at the two banquets. The premiums authorized by the 25th paragraph of the 4th clause of Mr. Shaw's will, which were awarded by the Florists' Club at its Chrysanthemum show in November last, under the direction of the Board of Trustees of the Garden, were offered for subjects calculated to broaden the scope of florists' work, and to afford opportunity for visitors to the exhibition to become familiar with choice specimens of plants not ordinarily found in the floral establishments of the city. To this end, competition for these premiums was opened to the general public without fee or reservation, and as a result of this liberality on the part of the Florists' Club, several valuable collections and specimen plants were exhibited from the middle and eastern States. Awards were made for orchids, \$150.00; new seedling Chrysanthemum, \$50.00; Dracænas, \$30.00; Cycads, \$15.00; Pandanus, \$30.00; Araucarias, \$15.00; Palms, \$135.00; and other decorative plants, \$30.00:—together \$460.00. A series of premiums amounting to \$40.00, offered for a collection of Oxalis plants, which are deserving of more general cultivation by amateurs than they receive, was not competed for.

THE SCHOOL OF BOTANY.

Since the presentation of my last report I have been assisted by Mr. Webber, who has attended to the necessary routine work of the School, including preparations for the regular lectures to undergraduates which are delivered by me. He has also conducted, under my direction, the laboratory electives for undergraduates, and special classes

in systematic botany, germination of seeds, and histology, and has taken special students for work on roots, biological botany, and fungi. A special class studied the structure and life history of ferns and mosses in the spring, under my instruction and that of Mr. Webber, and a class in analytical botany, which met at the Garden in the spring, was carried on partly by myself and in part by Mr. Hitchcock. Mr. Webber has continued his studies for the Doctor's degree, giving considerable time to germination work, and has also found time to prepare an important supplement to the *Flora of Nebraska* published some time since by Professor Bessey in connection with him, and will soon issue it as a contribution from the School.

So far as number of students and character of work done are concerned, there is no essential change from what was set forth in my last report. The facilities for special work afforded by the Garden and School of Botany have been made use of during the year by several botanists engaged in special work, and the results of work done at the School of Botany by Professor Pammel, of the Iowa Agricultural College, have just been published, constituting the eighth contribution from the School. Owing to depreciation in the value of the property constituting the endowment of the School, which from yielding an annual rental of \$5,400.00 when I was called to the School of Botany, has now come to yield something less than the \$3,500.00 guaranteed by Mr. Shaw's will, the available income is at present nearly consumed by the necessary salaries, so that for the past year no large addition has been made to either the library or instrumental equipment of the School. It has, however, proved possible to secure the few additions absolutely needed for the prosecution of current work; the material and library of the Garden have been freely drawn on when needed; and, when the occasion for such action arises, it will be possible for the Garden Board, if they think it expedient to do so, to supplement the income of the School of Botany by augmenting the means and appli-

ances of instruction, under the authority given in the third paragraph of the second clause of Mr. Shaw's will.

In closing this report I wish to express my appreciation of the interest and support given by the Board of Trustees, and in particular by the Garden Committee, during the past year; and of the faithful and able co-operation of my assistants, both at the Garden and the School of Botany.

Respectfully submitted,

WILLIAM TRELEASE,

Director.

St. Louis, Mo., Jan. 13, 1892.